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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/618,111	07/11/2003	James D.B. Smith	2003P08574US	4106

7590 03/09/2006

Siemens Corporation  
Intellectual Property Department  
170 Wood Avenue South  
Iselin, NJ 08830

EXAMINER

FEELY, MICHAEL J

ART UNIT	PAPER NUMBER
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1712

DATE MAILED: 03/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.



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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/618,111  
Filing Date: July 11, 2003  
Appellant(s): SMITH, JAMES D.B.

**MAILED**  
MAR 09 2006  
**GROUP 1700**

Brad Close (Reg. No. L0226)  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed January 20, 2006 appealing from the Office action mailed May 19, 2005.

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**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct. No amendment after final has been filed.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

5,904,984	Smith et al.	05-1999
6,369,183	Cook et al.	04-2002
4,427,740	Stackhouse et al.	01-1984

Declaration of James D. Smith, filed under 37 CFR 1.132 on February 24, 2005.

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### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

#### Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-9 and 11-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith et al. (US Pat. No. 5,904,984) in view of Cook et al. (US Pat. No. 6,369,183).

Regarding claims 1-9 and 11, Smith et al. disclose: *(1)* an LCT-epoxy polymer (column 2, line 22 through column 5, line 19); *(7)* further comprising a process step of mixing at least one anhydriding agent with said LCT-epoxy polymer (column 5, lines 20-56); *(8)* wherein said anhydriding agent is taken from the group consisting of 1-methylhexahydrophthalic anhydride and 1-methyltetrahydrophthalic anhydride (column 5, lines 35-41); *(9)* wherein said anhydriding agent is approximately 25-45% by weight of said LCT-epoxy polymer (column 5, lines 51-53); and *(11)* wherein said mixture is added to an electrical insulator as a coating before curing (Abstract; column 2, lines 22-29; Figure 2).

The composition of Smith et al. also contains inorganic particulate filler, including aluminum-based fillers, to improve the electrical properties of the resin (column 6, lines 45-50). However, the teachings of Smith et al. are deficient in that they do not teach: *(1)* a method of making a homogeneous alumoxane-LCT-epoxy polymer comprising:

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- Mixing at least one boehmite material with the LCT-epoxy resin under conditions to form a uniform dispersion and an essentially complete co-reactivity of the boehmite material with the LCT-epoxy resin;
- Curing the mixture to produce the homogeneous alumoxane-LCT-epoxy polymer;
  - Wherein the weight ratio of boehmite material to LCT-epoxy resin is between 3:17 and 13:7 (15-65% boehmite base on combined weight of boehmite and LCT-epoxy resin); and
  - Wherein the alumoxane-LCT-epoxy polymer has a dielectric strength of at least 1.2 kV/mil;
  - Wherein the alumoxane-LCT-epoxy polymer has a thermal conductivity in the traverse direction of at least 0.50 W/mK and in the thickness direction of at least 0.99 W/mK in an environment of 25°C;

(2) wherein the boehmite material comprises carboxylate-alumoxane; (3) wherein the carboxylate-alumoxane is 4-hydroxybenzoate-alumoxane; (4) wherein the alumoxane portions of the alumoxane-LCT-epoxy polymer is 20-50% by weight; (5) wherein the mixing step comprises first pre-heating the LCT-epoxy resin until it is clear; and (6) wherein the mixing step further comprises warming until said mixture is clear.

Cook et al. disclose a method of forming hybrid polymers and resins in which at least one component is a chemically modified carboxylate-alumoxane. The carboxylate-alumoxanes are chemically bonded into the polymer backbone through reaction of the appropriate functional groups of a polymer precursor with the carboxylate-alumoxane (*see column 1, lines 14-21*). This method is an alternative to the standard practice of adding filler to resin systems in order to

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enhance properties, such as thermal conductivity (see Background of the Invention: specifically column 1, line 52 through column 2, line 54; column 3, line 37 through column 4, line 16; column 6, lines 13-16). This method also avoids handling and dispersion problems, including phase separation and agglomeration of the filler in the polymer composite (see column 1, line 52 through column 2, line 54). This method can be applied to numerous polymer materials, including epoxy resins. The reaction mechanism can be found in Figure 10. Essentially, Cook et al. disclose: (1) a method of making a homogeneous alumoxane-epoxy polymer comprising:

- Mixing at least one boehmite material with the epoxy resin under conditions to form a uniform dispersion and an essentially complete co-reactivity of the boehmite material with the epoxy resin (column 11, line 52 through column 12, line 51; Figures 10 & 11);
- Curing the mixture to produce the homogeneous alumoxane-epoxy polymer (column 11, lines 29-51; Figures 7-9);
  - Wherein the weight ratio of boehmite material to epoxy resin is between 3:17 and 13:7 (column 14, lines 17-19; Table 1: column 25, lines 55-64);

(2) wherein the boehmite material comprises carboxylate-alumoxane (column 11, line 29 through column 12, line 10); (3) wherein the carboxylate-alumoxane is 4-hydroxybenzoate-alumoxane (column 11, line 65); (4) wherein the alumoxane portions of the alumoxane-epoxy polymer is 20-50% by weight (column 14, lines 17-19; Table 1: column 25, lines 55-64); (5) wherein the mixing step comprises first pre-heating the LCT-epoxy resin until it is clear (column 12, lines 24-51); and (6) wherein the mixing step further comprises warming until said mixture is clear (column 12, lines 24-51).

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Cook et al. do not mention the use of *LCT*-epoxy polymers; however, they disclose, “Although we have demonstrated the formation of alumoxane-epoxy composites using commercial resins such as Dow Chemical’s DER 332, combinations of DER 332 and DER 732, Union Carbide’s ERL (cycloaliphatic resin), and Shell’s EPI-REZ (a waterborne resin system), any commercially available epoxy resin can be used to prepare the carboxylate-alumoxane/epoxy polymer hybrid materials,” (column 12, lines 11-17). In light of this, *LCT*-epoxy polymers would have fallen under this umbrella of suitable materials – see *MPEP* 2144.07. Furthermore, one skilled in the art would have been motivated to employ this method in the method of Smith et al. in order to avoid the drawbacks of physically adding filler materials, especially aluminum-based filler materials, to their *LCT*-epoxy polymer compositions.

Lastly, the combined teachings of Smith et al. and Cook et al. are silent regarding dielectric strength and conductivity of the alumoxane-*LCT*-epoxy polymers. However, it appears that if one skilled in the art were to apply the technique of Cook et al. using the *LCT*-epoxy polymers of Smith et al., this property would have been an inherent result of the reaction between the carboxylate-alumoxane and the *LCT*-epoxy polymer – see *MPEP* 2112.01 II.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the technique of reacting a carboxylate-alumoxane with an epoxy resin to form a hybrid epoxy resin, as taught by Cook et al., with the *LCT*-epoxy resins of Smith et al. because the teachings of Cook et al. extend to all commercially available epoxy resins, resulting in a hybrid polymer having a desired set of properties provided by the alumoxane. This technique is an alternative to the standard practice of adding filler to resin systems and it also

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avoids handling and dispersion problems of filler materials, including phase separation and agglomeration of filler in the polymer composite.

Regarding claims 12-14, the combined teachings of Smith et al. and Cook et al. are as set forth above and incorporated herein. The scope of claims 12-14 is similar to the scope of claims 1-9 and 11; however, it further contains language regarding the steps of coating and impregnating the resin onto/into an electrical insulator, wherein the electrical insulator is a mica/glass insulating tape. The base reference of Smith et al. teaches these limitations (*see column 8, line 49 through column 10, line 7; and claim 3*).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the technique of reacting a carboxylate-alumoxane with an epoxy resin to form a hybrid epoxy resin, as taught by Cook et al., with the LCT-epoxy resins of Smith et al. because the teachings of Cook et al. extend to all commercially available epoxy resins, resulting in a hybrid polymer having a desired set of properties provided by the alumoxane. This technique is an alternative to the standard practice of adding filler to resin systems and it also avoids handling and dispersion problems of filler materials, including phase separation and agglomeration of filler in the polymer composite.

Regarding claims 15-19, the combined teachings of Smith et al. and Cook et al. are as set forth above and incorporated herein. The scope of claims 15-19 is similar to the scope of claims 1-9 and 11; however, it further contains the following property:

- the alumoxane-LCT-epoxy polymers are substantially free of particle wetting and micro-void formation.



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The combined teachings of Smith et al. and Cook et al. are silent regarding this property of the alumoxane-LCT-epoxy polymers. However, it appears that if one skilled in the art were to apply the technique of Cook et al. using the LCT-epoxy polymers of Smith et al., this property would have been an inherent result of the reaction between the carboxylate-alumoxane and the LCT-epoxy polymer – *see MPEP 2112.01 II*.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the technique of reacting a carboxylate-alumoxane with an epoxy resin to form a hybrid epoxy resin, as taught by Cook et al., with the LCT-epoxy resins of Smith et al. because the teachings of Cook et al. extend to all commercially available epoxy resins, resulting in a hybrid polymer having a desired set of properties provided by the alumoxane. This technique is an alternative to the standard practice of adding filler to resin systems and it also avoids handling and dispersion problems of filler materials, including phase separation and agglomeration of filler in the polymer composite.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith et al. (US Pat. No. 5,904,984) and Cook et al. (US Pat. No. 6,369,183) in view of Stackhouse et al. (US Pat. No. 4,427,740).

Regarding claim 10, the combined teachings of Smith et al. and Cook et al. are as set forth above and incorporated herein. The combined teachings are silent regarding the addition of zinc naphthenate or chromium acetylacetonate.

Stackhouse et al. disclose an insulated electrical member adapted for high voltage-use, wherein the material is impregnated with an epoxy resin (Abstract; column 6, lines 50-56). They

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further disclose, “Typical reactive impregnating compositions comprise, for example, bisphenol A epoxy resin; acid anhydride curing agent, such as NADIC methyl anhydride or 1-methyltetrahydrophthalic anhydride; reactive diluent, such as neopentyl diglycidyl ether or vinyl cyclohexanone dioxide; *and latent accelerator, such as chromium acetylacetonate*, to produce a low viscosity composition of about 80 cps at 25°C,” (column 6, line 67 through column 7, line 6).

The teachings of Stackhouse et al. demonstrate that chromium acetylacetonate is recognized in the art as a suitable latent accelerator for epoxy/anhydride systems used to impregnate electrical insulating materials. In light of this, it has been found that the selection of a known material based on its suitability for its intended use supports a *prima facie* obviousness determination – *see MPEP 2144.07*.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to add a latent catalyst of zinc naphthenate or chromium acetylacetonate, as taught by Stackhouse et al., to the combined teachings of Smith et al. and Cook et al. because Stackhouse et al. demonstrate that chromium acetylacetonate is recognized in the art as a suitable latent accelerator for epoxy/anhydride systems used to impregnate electrical insulating materials.

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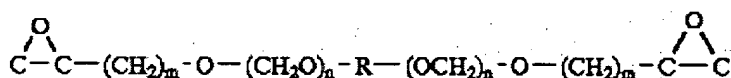
**(10) Response to Argument**

The Applicant has set forth the following arguments:

- *Examiner's citing of the omnibus phrase in Cook '183 certainly can't be taken at face value, and it cannot be enabling.*

Applicant does not say *why* any commercially available resin can't be substituted and *why* any commercially available resin can't be enabling. Applicant also fails to demonstrate *how* and *why* the combined teachings of Cook et al. and Smith et al. would produce a resin without the crystalline structure of the LCT resin presently claimed.

Smith et al. disclose an epoxy resin of the following formula:

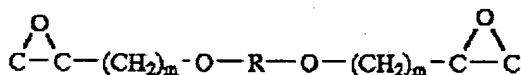


wherein: m is an integer of 1-20;

n is an integer of 0-20; and

R is a mesogen selected from the set consisting of (a)-(p)

Furthermore, when n is 0, the structure looks like this:



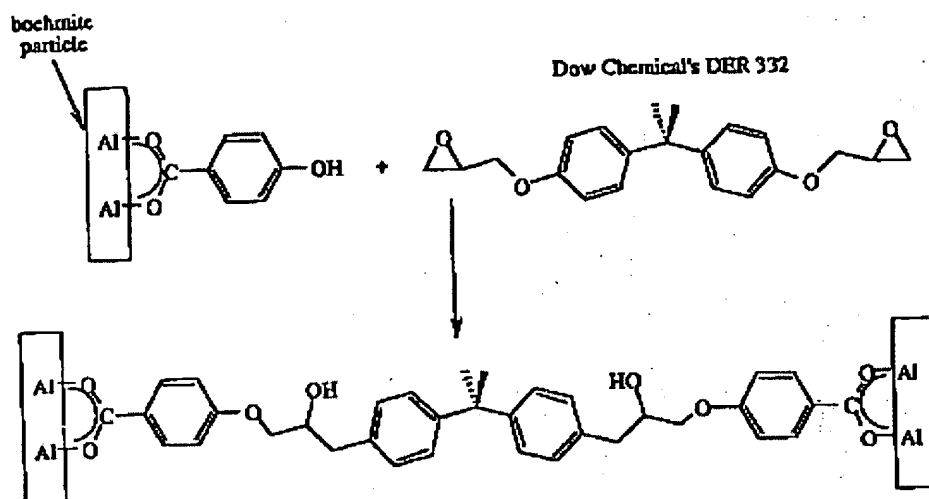
wherein: m is an integer of 1-20;

n is an integer of 0-20; and

R is a mesogen selected from the set consisting of (a)-(p)

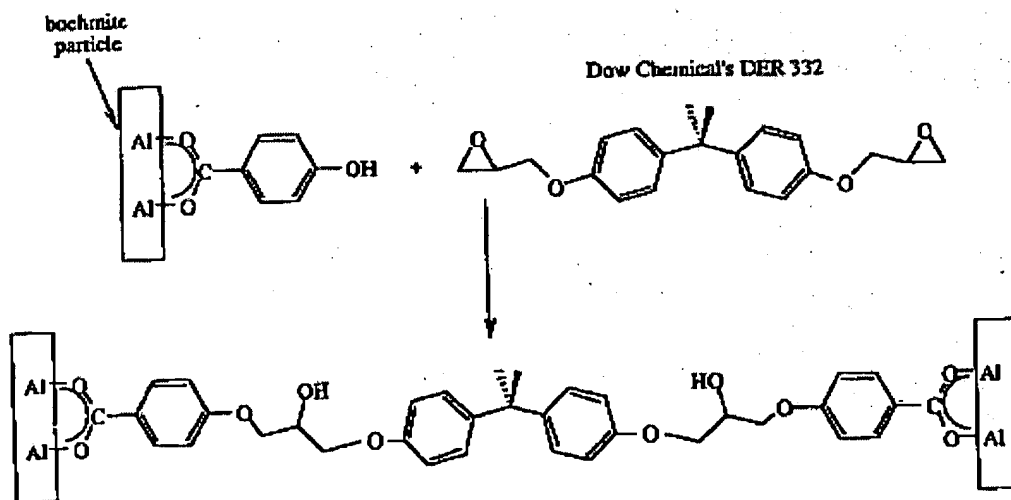
Cook et al. disclose a carboxylate-alumoxane/epoxy hybrid material formed from the following reaction (*also see Figure 10*):

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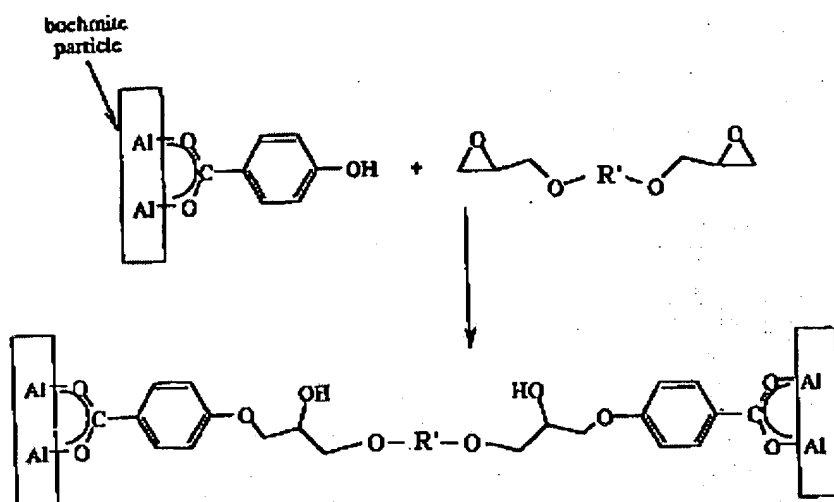
wherein R' is a bivalent skeletal structure.

It should be noted that reaction mechanism presented by Cook et al. is slightly flawed in that they fail to account for the oxygen atoms bound directly to the bisphenol group after the ring-opening reaction takes place – the reaction is not atomically balanced. One skilled in the art would have recognized that these oxygen atoms do not participate in the ring opening reaction. Hence, the following would more accurately represent the reaction mechanism of Cook et al. :



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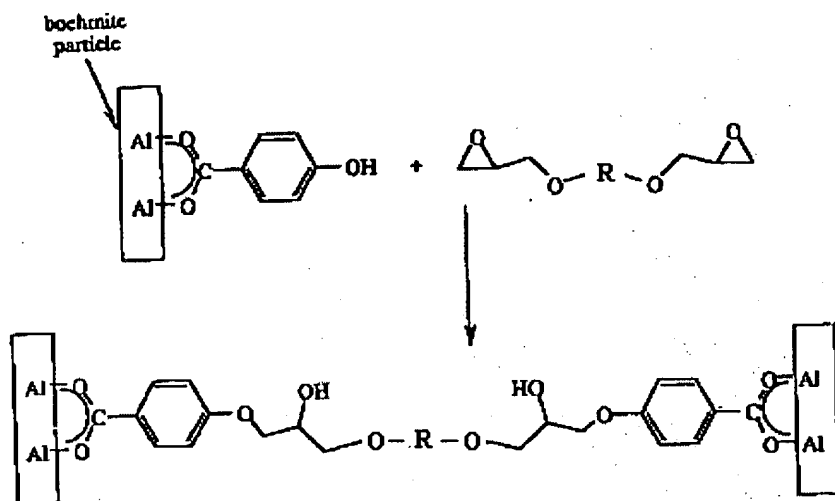
This can be represented in a more generic fashion as follows:



wherein R' is a bivalent skeletal structure.

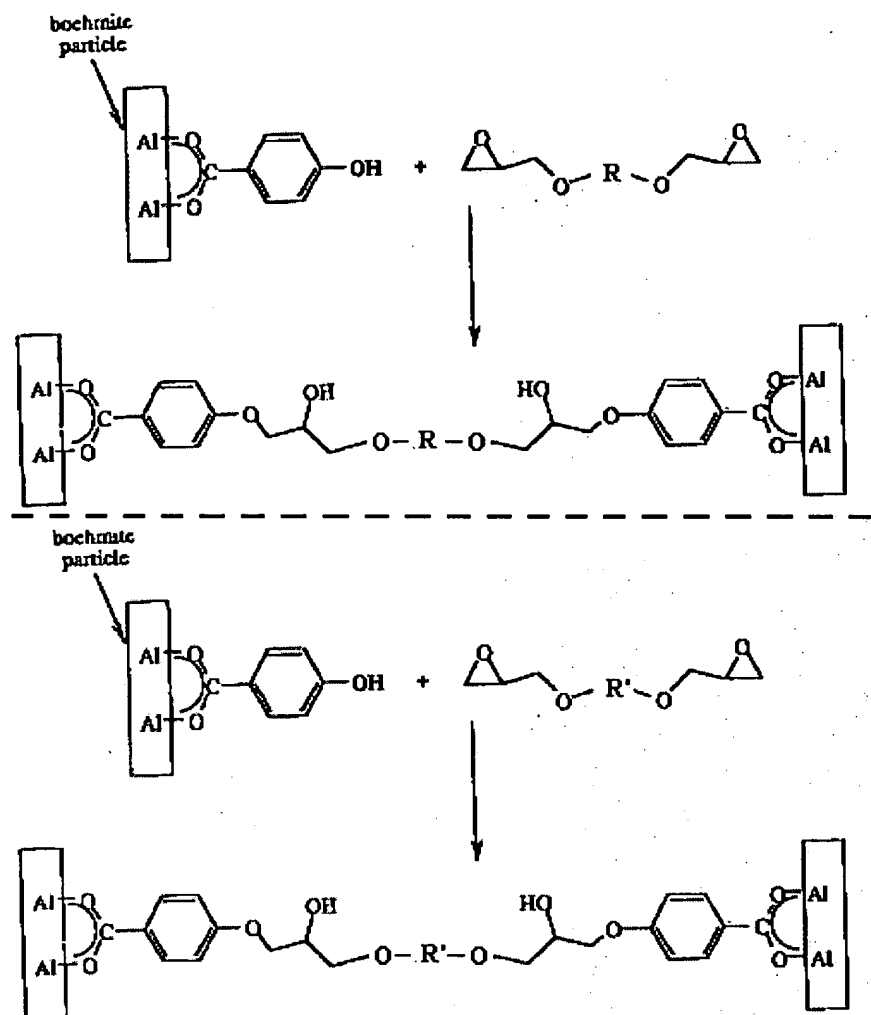
Turning to the instant invention, Applicant discloses a very similar hybrid material wherein carboxylate-alumoxanes are reacted with a "LCT-epoxy" resin (*see paragraphs 0034-0035*). In their example, they use a biphenol LCT-epoxy; however, they disclose that Examples of other LCT's can be found in US Pat. No. 5,904,984, *which is Smith et al.* The reaction mechanism of the instant invention involves reacting two carboxylate-alumoxanes and an "LCT-epoxy" resin of Smith et al. Therefore, in its simplest form ( $n=0$ ,  $m=1$ ), the instant invention is formed by the following reaction mechanism:

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wherein R is a bivalent mesogen skeletal structure.

The following is a side-by-side comparison of the reaction mechanism of the instant invention (top) and the reaction mechanism of Cook et al. (bottom). The only difference here is the presence of R (bivalent mesogen skeletal structure) vs. the presence of R' (bivalent generic skeletal structure). The foundation of the obviousness rejection is based on this similarity. It is further supported by the fact that Cook et al. extends their reaction mechanism to include *any commercially available epoxy resin*, and that their hybrid materials are used as an alternative to adding fillers.



In other words, Cook et al. teach the same reaction mechanism, except that they do not explicitly disclose the use of mesogen-containing epoxy resins. Based on the extended teachings of Cook et al. it would have been obvious to substitute the generic diepoxy resin with mesogen-containing diepoxy resins, such as those taught by Smith et al., because the skeleton structure appears to have no impact on the reaction mechanism. Such a substitution would have yielded the exact same reaction mechanism of the instant invention (*see above and paragraphs 0034-0035 of the specification*). Furthermore, it has been found that a chemical and its properties are

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inseparable. In light of this, the claimed properties would have been an inherent result of these combined teachings.

- ***Even if such a broad statement were enabling, LCT resins were not commercially available resins at the time of Cook.***

An obviousness determination is based on what is available to the skilled artisan at the time of the instantly claimed invention. Although there is no evidence of such a claim, Applicant claims that the LCT-epoxies of Smith et al. were not commercially available at the time of the Cook et al. reference. Regardless of whether this is true or false, the fact is that the Smith et al. reference was published almost three years prior to the Cook et al. reference. Both references would have been available to the skilled artisan at the time of the invention. At that time, a skilled artisan would have been able to obviously combine these teachings to extend the hybrid materials of Cook et al. to include epoxy resins having mesogen skeletal structures.

- ***Even if one were to combine Cook with Smith '984 they would still not get applicant's claimed invention. The(y) would be expected to get, and in all likelihood would get a resin without a crystalline structure. This was pointed out in the February 24<sup>th</sup> affidavit, paragraph 6, where Smith states that he and his colleagues performed experiments of mixing boehmite materials with resins and obtained ruined resins.***

As stated in the obviousness rejection, the hybrid epoxy materials taught by Cook et al. represent an alternative to the standard practice of adding filler to resin systems in order to enhance properties. When combined with the teachings of Smith et al., the hybrid materials of



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Cook et al. would have served as an alternative to the addition of filler in Smith et al. because the hybrid materials integrate the aluminum into the chemical structure of the epoxy resin.

Although the mixing of additional particles (*other than the boehmite/alumoxane*) in a traditional non-reactive filler/matrix relationship likely would have disrupted the crystalline structure of the LCT-resin, this appears to be a moot point in light of the combined teachings. This is because the boehmite/alumoxane materials and the epoxy resin actually co-react with one another to form a hybrid material.

The concept of integration/co-reaction of the alumoxane materials into/with the resin backbone to form hybrid materials is equally taught by Cook et al. (*see Figure 10*) and the instant Specification (*see paragraph 0033*). As described above, the only difference between the reaction mechanism set forth in instant invention and the reaction mechanism set forth in Cook et al. is the presence of R (bivalent mesogen skeletal structure) vs. the presence of R' (bivalent generic skeletal structure). The alumoxanes used in Cook et al. are the same alumoxanes used in the instant invention. Hence, one would have reasonably expected some level of success because the bivalent skeleton structure does not actually take part in the reaction.

Furthermore, the Applicant explicitly discloses in paragraph 0035 of the Specification that carboxylate-alumoxanes are reacted with the LCT-epoxy resins to form alumoxane-LCT-epoxies, wherein, "Examples of other LCT's can be found in US Pat. No. 5,904,984 (Smith et al.), which is incorporated herein by reference." If this sworn statement is indeed accurate, then it appears that the instant invention may also inoperable.

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- *With respect to the “sufficiency” of the affidavit filed February 24, 2005.*

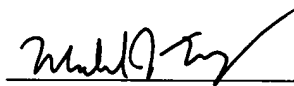
The Examiner maintains that the affidavit fails to provide evidence of unexpected results of the instant invention and/or inoperability of the prior art. Applicant discusses tests and experimental results; however, there is no *showing or proof* of these tests or experimental results to support these assertions. Due to the absence of true *evidence*, Applicant's assertions constitute mere argument – *see MPEP 716.01(c)*.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

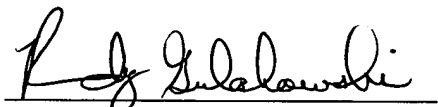
For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

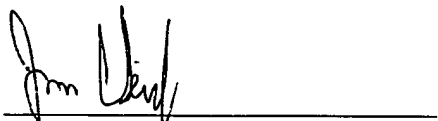


Michael J. Feely  
Primary Examiner, Art Unit 1712

Conferees:



Randy P. Gulakowski  
Supervisory Patent Examiner, Art Unit 1712



James J. Seidleck  
Supervisory Patent Examiner, Art Unit 1711